Master's Thesis

[quantum] Asymptotic continuity of restricted quantum relative entropies under general channels
Asymptotic continuity is a property in the form of inequalities (classically known also as inequalities of the reverse-Pinker type) that is necessary to prove upper bounds on operational capacities.

The (quantum) relative entropy (also known as quantum divergence and classically also known as Kullback-Leibler divergence), can be used to define various entanglement measures many of which have a proven asymptotic continuity.

Of particular interest are the restricted quantum relative entropies defined by Marco Piani (https://arxiv.org/abs/0904.2705), many of which satisfy asymptotic continuity (A.S.)


In the above there are maybe 2-3 different proof styles. We can group the results in the above as follows:

- A.S. for entropy, conditional entropies, mutual information, conditional mutual information
- A.S. for relative entropies with infimum over states on the second argument
- A.S. relative entropies with infimum over state *and maximization over measurement channels*

The goal of the project is to generalize the last case to asymptotic continuity for relative entropies with infimum over state and maximization over *general* channels.

- Partial results toward this goal can be found in the appendix of my PhD thesis: http://web.math.ku.dk/noter/filer/phd18rf.pdf
- Such a result would have immediate applications to this paper: https://arxiv.org/abs/1801.02861

Possible new proof directions are

- using Renyi $\alpha$-relative entropies with the limit $\alpha\rightarrow 1$
- using Kim’s operator inequality from https://arxiv.org/abs/1210.5190 to get an operator inequality looking like a reverse strong subadditivity (see https://www.youtube.com/watch?v=P3-xl1u1Y2s for a good overview and in particular at minute 31:20 for the reverse SSA)

**Prerequisites**

Knowledge of quantum information is highly recommended/required. Knowledge of matrix analysis will be a strong advantage.

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